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LI. *Electrical Experiments, made in pursuance of those by Mr. Canton, dated Decem. 3, 1753; with Explanations by Mr. Benjamin Franklin, Communicated Mr. Peter Collinson, F. R. S.*

Philadelphia, March 14, 1755.

Principles.

Read Dec. 18, 1755. I. **E**lectric atmospheres, that flow round non-electric bodies, being brought near each other, do not readily mix and unite into one atmosphere, but remain separate, and repel each other.

This is plainly seen in suspended cork balls, and other bodies electrified.

II. An electric atmosphere not only repels another electric atmosphere, but will also repel the electric matter contained in the substance of a body approaching it; and without joining or mixing with it, force it to other parts of the body, that contained it.

This is shewn by some of the following experiments.

III. Bodies electrified negatively, or deprived of their natural quantity of electricity, repel each other, (or at least appear to do so, by a mutual receding) as well as those electrified positively, or which have electric atmospheres.

This is shewn by applying the negatively charged wire of a phial to two cork balls, suspended by silk threads, and by many other experiments.

Prepa-

Preparation.

Fix a tassel of 15 or 20 threads, 3 inches long, at one end of a tin prime conductor; (mine is about 5 feet long, and 4 inches diameter), supported by silk lines.

Let the threads be a little damp, but not wet.

Experiment I.

Pass an excited glass tube near the other end of the prime conductor, so as to give it some sparks, and the threads will diverge.

Because each thread, as well as the prime conductor, has acquired an elastic atmosphere, which repels, and is repelled by, the atmospheres of the other threads: if those several atmospheres would readily mix, the threads might unite, and hang in the middle of one atmosphere, common to them all.

Rub the tube afresh, and approach the prime conductor therewith, crossways, near that end, but nigh enough to give sparks; and the threads will diverge a little more.

Because the atmosphere of the prime conductor is pressed by the atmosphere of the excited tube, and driven towards the end where the threads are, by which each thread acquires more atmosphere.

Withdraw the tube, and they will close as much.

They close as much, and no more, because the atmosphere of the glass tube, not having mix'd with the atmosphere of the prime conductor, is withdrawn
intire,

intire, having made no addition to, or diminution from, it.

Bring the excited tube under the tuft of threads, and they will close a little.

They close, because the atmosphere of the glass tube repels their atmospheres, and drives part of them back on the prime conductor.

Withdraw it, and they will diverge as much.

For the portion of atmosphere, which they had lost, returns to them again.

Experiment II.

Excite the glass tube, and approach the prime conductor with it, holding it across near the opposite end, to that on which the threads hang, at the distance of 5 or 6 inches. Keep it there a few seconds, and the threads of the tassels will diverge. Withdraw it, and they will close.

They diverge, because they have received electric atmospheres from the electric matter before contained in the substance of the prime conductor; but which is now repelled and driven away, by the atmosphere of the glass tube, from the parts of the prime conductor, opposite and nearest to that atmosphere, and forced out upon the surface of the prime conductor at its other end, and upon the threads hanging thereto. Were it any part of the atmosphere of the glass tube, that flowed over and along the prime conductor to the threads, and gave them atmospheres (as in the case when a spark is given to the prime conductor, from the glass tube), such part of the tube's

tube's atmosphere would have remained, and the threads continue to diverge; but they close on withdrawing the tube, because the tube takes with it *all its own Atmosphere*, and the electric matter, which had been driven out of the substance of the prime conductor, and formed atmospheres round the threads, is thereby permitted to return to its place.

Take a spark from the prime conductor, near the threads, when they are diverged as before, and they will close.

For by so doing you take away their atmospheres, composed of the electric matter driven out of the substance of the prime conductor, as aforesaid, by the repellency of the atmosphere of the glass tube. By taking this spark you rob the prime conductor of part of its natural quantity of the electric matter; which part so taken is not supplied by the glass tube, for when that is afterwards withdrawn, it takes with it its whole atmosphere, and leaves the prime conductor electrified negatively, as appears by the next operation.

Then withdraw the tube, and they will open again.

For now the electric matter in the prime conductor, returning to its equilibrium, or equal diffusion, in all parts of its substance, and the prime conductor having lost some of its natural quantity, the threads connected with it lose part of theirs, and so are electrified negatively, and therefore repel each other, by *Pr. III.*

Approach the prime conductor with the tube near the same place as at first, and they will close again.

Because

Because the part of their natural quantity of electric fluid, which they had lost, is now restored to them again, by the repulsion of the glass tube forcing that fluid to them from other parts of the prime conductor : so they are now again in their natural state.

Withdraw it, and they will open again.

For what had been restored to them is now taken from them again, flowing back into the prime conductor, and leaving them once more electrified negatively.

Bring the excited tube under the threads, and they will diverge more.

Because more of their natural quantity is driven from them into the prime conductor, and thereby their negative electricity increased.

Experiment III.

The prime conductor not being electrified, bring the excited tube under the tassel, and the threads will diverge.

Part of their natural quantity is thereby driven out of them into the prime conductor, and they become negatively electrified, and therefore repel each other.

Keeping the tube in the same place with one hand, attempt to touch the threads with the finger of the other hand, and they will recede from the finger.

Because the finger being plunged into the atmosphere of the glass tube, as well as the threads, part of its natural quantity is driven back through the

hand and body, by that atmosphere, and the finger becomes, as well as the threads, negatively electrified, and so repels, and is repelled by them. To confirm this, hold a slender light lock of cotton, two or three inches long, near a prime conductor, that is electrified by a glass globe, or tube. You will see the cotton stretch itself out towards the prime conductor. Attempt to touch it with the finger of the other hand, and it will be repelled by the finger. Approach it with a positively charged wire of a bottle, and it will fly to the wire. Bring near it a negatively charged wire of a bottle, it will recede from that wire in the same manner, that it did from the finger; which demonstrates the finger to be negatively electrified, as well as the lock of cotton so situated.

LII. Extract of a Letter concerning Electricity, from Mr. B. Franklin to Mons. Delibard, inclosed in a Letter to Mr. Peter Collinson, F. R. S.

Philadelphia, June 29, 1755.

Read Dec. 18, 1755. **Y**OU desire my opinion of Pere Baccaria's Italian book. I have read it with much pleasure, and think it one of the best pieces on the subject, that I have seen in any language. Yet as to the article of water-spouts, I am not at present of his sentiments; though I must own with you, that he has handled it very ingeniously. Mr. Collinson has my opinion of whirlwinds and